Technical Memorandum:
Evaluation of Potential "Hot Spot" Occurrences and Removal
For Radiologically Impacted Soil
West Lake Landfill OU-1

INTRODUCTION

The West Lake Landfill Superfund Site consists of two Operable Units (OUs). OU-1 includes two areas, Areas 1 and 2, where radiologically impacted soil was mixed with municipal solid waste and construction debris. A Remedial Investigation report was previously completed for OU-1 (EMSI, 2000). A draft Feasibility Study (FS) for OU-1 was developed to identify and evaluate potential remedial alternatives for the radiological impacted soils present in Areas 1 and 2 of the West Lake Landfill (EMSI, 2000).

During the development of remedial alternatives in the FS, the Respondents considered the potential presence of "hot spots" and evaluated the potential need for consideration of hot spot removal as part of the remedial alternative evaluation for OU-1. For CERCLA municipal landfills such as the West Lake Landfill, EPA guidance indicates that "hot spots consist of highly toxic and/or highly mobile material and present a potential principal threat to human health and the environment." (EPA, 1993). EPA guidance further states that "Hot spots at CERCLA municipal landfills typically consist of liquids, buried drums or other highly mobile and toxic wastes that are present in a discreet area or portion of the landfill." As discussed further below, the FS concluded that there are no "hot spots" in the West Lake Landfill, and that implementation of hot spot removal as part of the remedial actions that may be undertaken for OU-1 is not warranted based on EPA guidance. Moreover, it is not practical and could potentially result in unacceptable risks to remediation workers. The additional risks involved in a hot spot removal significantly exceed the risks of leaving the waste in place as proposed in the FS.

The EPA Remedial Project Manager (RPM) requested at a June 14, 2000 meeting that the OU-1 Respondents prepare a separate technical memorandum addressing the evaluation of potential hot spots and possible removal of such hot spots. Specifically, at the June 14, 2000 meeting among EPA, a representative of the Missouri Department of Natural Resources (MDNR) and the Respondents, the EPA RPM requested the Respondents to submit a technical memorandum to evaluate potential "hot spot" removal of radiologically impacted soil present in Areas 1 and 2 of OU – 1. This memorandum responds to that request. A quantitative evaluation of the costs and risks associated with hot spot removal, however, requires that the Respondents proceed on the basis of an assumed volume of hot spot material. Because there are no "hot spots" at the West Lake Landfill, no basis exists to make such an assumption. Therefore, any such assumption would be arbitrary and the estimated costs would not be meaningful. Accordingly, the analysis that follows is primarily a qualitative analysis.

In evaluating the applicability of hot spot removal for OU-1, this memorandum summarizes the applicability to OU-1 of the use of the presumptive remedy of containment for municipal landfill sites; provides a discussion from EPA guidance regarding how "hot spots" should be addressed; includes a quantitative discussion of potential risks to workers and the public associated with excavation of filled material and removal of radionuclides within Areas 1 and 2 that are dispersed within soil material that is further dispersed throughout the overall, heterogeneous matrix of municipal refuse, construction and demolition debris and other, non-impacted soil materials; and concludes that hot spot removal for OU-1 at the West Lake Landfill is not appropriate based on EPA guidance documents.

APPLICATION OF THE PRESUMPTIVE REMEDY TO OU-1 AT THE WEST LAKE LANDFILL

Section 300.430(a)(iii)(B) of the NCP contains the expectation that engineering controls, such as containment, will be used for waste that poses a relatively low long-term threat or where treatment is impracticable (USEPA, 1990). The preamble to the NCP identifies municipal landfills as a type of site where treatment of the waste may be impracticable because of the size and heterogeneity of the contents (55 FR 8704). Waste in CERCLA landfills usually is present in large volumes and is a heterogeneous mixture of municipal waste frequently co-disposed with industrial and/or hazardous waste. Because treatment is usually impracticable, EPA generally considers containment to be the appropriate response action, or the "presumptive remedy" for the source areas of municipal landfill sites (USEPA, 1993).

Based upon EPA experiences at numerous CERCLA municipal landfill sites and as a result of the initiatives undertaken as part of the Superfund Accelerated Cleanup Model, EPA has initiated use of and developed presumptive remedies for specific types of sites, contaminants, or both, including CERCLA municipal landfill sites. Based upon its experience, EPA has identified the following components for consideration in applying the presumptive remedy approach for source area containment at CERCLA municipal landfills:

- Landfill cap;
- Source area ground-water control to contain plume;
- Leachate collection and treatment;
- Landfill gas collection and treatment, and/or
- Institutional controls to supplement engineering controls.

EPA's Remedial Project Manager (RPM) has previously indicated that the presumptive remedy for CERCLA municipal landfills should be considered in the development and evaluation of potential remedial alternatives for the West Lake Landfill. Occurrences of radionuclides within Areas 1 and 2 are dispersed within soil material that is further dispersed throughout the overall, heterogeneous matrix of municipal refuse, construction and demolition debris and other, non-impacted soil materials. Consequently, excavation of the radiologically impacted materials for possible ex situ treatment techniques or possible offsite disposal is impracticable.

Of the source containment options identified by EPA as part of the presumptive remedy approach, the landfill cap and institutional control actions are considered applicable to Areas 1 and 2. As there is no plume of groundwater contamination associated with Areas 1 and 2, source area ground-water control is not applicable to Areas 1 and 2. With the possible exception of the intermittent and highly localized seep in the southwestern portion of Area 2, no leachate discharge has been identified from Areas 1 and 2. Based on the results of the radon monitoring conducted during the RI, collection or control of radon gas is not considered necessary.

The West Lake Landfill site had been used for waste disposal and other industrial activities for approximately 50 years and will remain a waste disposal site forever regardless of any remedial actions that may be taken with respect to OU-1. As discussed in the FS, existing institutional controls will continue to be used to control current and future use of the entire West Lake Landfill and Areas 1 and 2 in particular. Institutional controls along with the existing landfill fencing are used to control and restrict access to Areas 1 and 2. The existing institutional controls consist of a deed restriction recorded in June 1997 against the entire landfill prohibiting residential use and groundwater use. An additional deed restriction was recorded in January 1998 restricting construction of buildings and underground utilities and pipes within Areas 1 and 2. These deed restrictions cannot be terminated without the written approval of the current owners, EPA, and MDNR. Also, as part of all alternatives in the FS except the No Action alternative, additional institutional controls in the form of additional deed restrictions would be implemented to prevent or control potential future uses of Areas 1 and 2 not currently expressly restricted. For example, construction of office buildings or other commercial or industrial structures could be performed in areas adjacent to Areas 1 and 2 in the future. As part of this type of development, there may be an expectation of using Areas 1 and 2 for ancillary uses such as landscaping, parking lots, or open storage. An additional deed restriction would be implemented to prevent use of Areas 1 and 2 for parking lots, employee recreation, open storage or other similar uses that may be ancillary to future commercial/industrial development of the landfill areas outside of Areas 1 and 2.

In addition, irrespective of the radiologically impacted soil present in Areas 1 and 2 of OU – 1, the entire West Lake Landfill Superfund Site is a landfill and will remain a landfill. The Missouri Solid Waste Rules (10 CSR 80) require owners of solid waste disposal areas, as part of closure of the solid waste disposal area to "Submit evidence to the department that a notice and covenant running with the land has been recorded with

the recorder of deeds in the county where the sanitary landfill is located. The notice and covenant shall specify ….. that the use of the land in any manner which interferes with closure plans, and post-closure plans filed with the department, is prohibited."

EPA GUIDANCE ON "HOT SPOTS" RELATIVE TO RADIOLOGICALLY IMPACTED SOIL AT THE WEST LAKE LANDFILL

EPA's guidance for presumptive remedies at CERCLA municipal landfill sites also describes issues to be addressed related to the characterization and possible treatment of "hot spots". Hot spots consist of highly toxic and/or highly mobile material and present a potential principal threat to human health or the environment (EPA, 1993). EPA guidance (EPA, 1993) states that "The overriding question is whether the combination of the waste's physical and chemical characteristics and volume is such that the integrity of the new containment system will be threatened if the waste is left in place." Neither the physical nor chemical characteristics of the radiologically impacted materials in OU-1 will affect the integrity of a containment system (landfill cover). Consequently, the answer to the overriding question in determining whether hot spot removal is appropriate is that the integrity of the containment remedy presumed by EPA for CERCLA municipal landfill sites would not be threatened if the radiologically impacted soil is left in place. Hot spot removal is not considered appropriate for OU-1.

Excavation or treatment of hot spots is generally practicable where the waste type or mixture of wastes is in a discrete, accessible location of a landfill. EPA guidance provides that a hot spot should be large enough that its remediation would significantly reduce the risk posed by the overall site, but small enough that it is reasonable to consider removal or treatment.

EPA guidance identifies four questions to be addressed to determine whether characterization and/or treatment of hot spots are warranted. All four of these questions must be answered in the affirmative to support a decision to characterize and treat hot spots. These four questions are as follows:

- Does evidence exist to indicate the presence and approximate location of waste?
- Is the hot spot known to be principal threat waste?
- Is the waste in a discrete accessible part of the landfill?
- Is the hot spot known to be large enough that its remediation will reduce the threat posed by the overall site but small enough that it is reasonable to consider removal (e.g., 100,000 cubic yards or less)?

As to the first question, reliable historic information regarding the location of the radionuclide materials does not exist. Surveys and sampling conducted as part of the RI

have identified the general locations of the occurrences of the radiologically impacted materials within Areas 1 and 2. Results of the RI investigations indicate that the radiologically impacted soil material is dispersed both laterally and vertically throughout the overall, heterogeneous matrix of municipal refuse, construction and demolition debris, and unimpacted soil cover material. Therefore, the exact location, boundaries and extent of the radiologically impacted materials cannot be precisely located and can only be approximately estimated. The answer to the first question is no.

Principal threat wastes addressed by the presumptive remedy guidance for which hot spot remediation is most likely to be appropriate include liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile material. As defined in A Guide to Principal Threat and Low Level Threat Wastes (USEPA, 1991), principal threat wastes are "those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur." "Source material" is defined in the principal threat guidance as material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, to surface water, to air, or act as a source for direct exposure. The guidance also states that no threshold level of toxicity/risk has been established to equate to a "principal threat", but that where toxicity and mobility of source material combine to pose a potential risk of 1×10^{-3} or greater, generally treatment alternatives should be considered.

Radiologically impacted materials at the West Lake Landfill occur in soil material, not liquids. The radionuclides are not present in a discrete area, unit, or zone of the landfill. Specifically the radiologically impacted soils are interspersed within the overall landfill matrix at depths ranging from the ground surface to over 20 feet below ground surface, making retrieval of the impacted materials impracticable. Similarly, the types of radionuclides, and the presence of the radionuclides in soil material, result in the radionuclide occurrences at the West Lake Landfill being generally immobile. Therefore, in accordance with the guidance, the radiologically impacted materials are not considered a source material or principal threat waste. The answer to the second question is no.

As the radionuclides are not located in a discrete area, the answer to the third question is no and hot spot removal is not appropriate. This conclusion is further supported by answering the "overriding question" of "whether the combination of the waste's physical and chemical characteristics and volume is such that the integrity of the new containment system will be threatened if the waste is left in place." (EPA, 1993) As discussed in the OU-1 Feasibility Study (EMSI, 2000), no significant risk to human health or the environment would occur if a containment remedy were implemented at the Site. There is no indication of widespread or even significant groundwater contamination from the radionuclides at the site and evaluations conducted as part of the RI report indicate that potential future migration is limited and should not significantly affect the underlying or downgradient groundwater quality. The only significant exposure pathways identified by the Baseline Risk Assessment (BRA) entailed gamma radiation from or direct contact with radiologically impacted soil. Both of these exposure pathways could be addressed through installation of a containment (landfill cover) system, supplemented with

institutional controls. Radiologically impacted soil at the West Lake Site can easily and effectively be isolated through installation of a cover system. Neither the physical nor chemical characteristics of the radiologically impacted materials will affect the integrity of the landfill cover. Consequently, the answer to the overriding question in determining whether hot spot removal is appropriate is that the integrity of the containment remedy presumed by EPA for CERCLA municipal landfill sites would not be threatened if the radiologically impacted soil is left in place, and hot spot removal is not appropriate.

As to the fourth question, removal of the radionuclides would require excavation of approximately 130,000 cubic yards of refuse containing radiologically impacted soil plus an additional approximately 120,000 cubic yards of refuse present as overburden that is not expected to contain radiologically impacted soil. This combined volume of over approximately 250,000 cubic yards is substantially greater than the volume of 100,000 cubic yards or less that is considered by the guidance to be reasonable for removal. Therefore, excavation and offsite disposal of refuse containing radiologically impacted soil is not reasonable and not warranted.

As stated above, EPA guidance identifies four questions to be addressed to determine whether characterization and/or treatment of hot spots are warranted and all four of these questions must be answered in the affirmative to support a decision to characterize and treat hot spots. None of the four questions can be answered in the affirmative. Therefore, hot spot removal is not appropriate and not warranted. This conclusion is consistent with the evaluation of the overriding question of whether hot spot removal is necessary to protect the integrity of the containment remedy presumed by EPA for CERCLA municipal landfill sites.

THEORETICAL LIMITATIONS TO REMOVAL AND OFFSITE DISPOSAL OF RADIOLOGICALLY IMPACTED SOIL

As previously discussed, the radiologically impacted materials are present in soil material contained within the overall matrix of municipal refuse, construction and demolition debris and unimpacted soil, making retrieval of the impacted materials impracticable. Despite the conclusion that hot spot removal is not necessary, and to address EPA's request that hot spot removal scenarios be discussed, the following paragraphs present theoretical limitations to removal and off-site disposal of radiologically impacted soils. Excavation and offsite disposal of radiologically impacted soil would require either:

1. Excavation, loading, offsite transport via truck, offloading and transfer to railcars, and subsequent transport to an out-of-state facility for disposal of large volumes of municipal solid waste and debris that contains both radiologically impacted and non-impacted soil; or alternatively

2. Excavation of the solid waste and soil followed by screening or other physical separation of the radiologically impacted soil from the solid waste followed by loading, offsite transport via truck, off-loading and transfer to railcars, and

subsequent transport to an out-of-state facility for disposal of the soil fraction along with re-disposal onsite of the excavated refuse and debris.

If the first option were to be selected, a large volume, greater than the 100,000 cubic yard upper limit suggested in EPA's CERCLA Municipal Landfill guidance document as reasonable to consider for removal, would need to be excavated and sent for offsite disposal. This transportation would likely involve highway trucks travelling approximately 20 miles one-way or more on local roads and highways involving approximately 5,000 to 10,000 truck trips. The material would subsequently be transferred from the trucks to railcars at a truck/rail car transfer facility that would need to be built in the St. Louis area, and subsequent rail transport to an out-of-state disposal facility located in Utah, Texas, Washington or elsewhere. The rail distance to the Utah facility would be approximately 1,600 miles.

Under the second option, the radiologically impacted soil fraction would, to the maximum extent possible, initially be separated from the excavated refuse to reduce the total volume of material to be disposed offsite. Separation of the soil from the refuse and debris would be performed using a grizzly and/or vibrating screen. The act of screening would result in mixing of the more highly impacted soil with less impacted and unimpacted soil. After screening, the impacted soil would be loaded into trucks for transport to the rail transfer facility and subsequent rail transport to an out-of-state disposal facility as described above.

Removal of the highest levels of radionuclide occurrences from Area 2 would not eliminate the need for or reduce the scope of potential containment measures. It is unrealistic to assume that all of the radiologically impacted soil could be removed as portions of this soil occur at depths of 10 to 20 feet below ground surface. Consequently, there would still exist a need for implementation of a containment system. Furthermore, even if excavation of the refuse, debris and soil with attendant offsite disposal of impacted soil and refuse were to occur, it would not alleviate the need for installation of a cover system, as the site would still remain a municipal solid waste landfill. After completion of the excavation activities, the excavations would have to be filled and/or graded out, the surface of the landfill would have to be graded and contoured and a new cover system would have to be installed. Consequently, excavation of the radiologically impacted soil does not eliminate the need for or reduce the scope of installation of a new landfill cover system.

In contrast, containment measures, such as capping, can effectively address both the potential areas of higher levels of radionuclides as well as the overall extent of radionuclides in Areas 1 and 2 and the adjacent solid wastes.

POTENTIAL RISKS ASSOCIATED WITH REMOVAL OF RADIONUCLIDES

Excavation and offsite disposal of radiologically impacted soil pose potential risks to both remediation workers and other onsite workers as well as to the public at large.

Screening of the refuse to separate out the soil material would be a difficult, time- and labor-consuming and potentially hazardous activity. Screening of refuse material would necessitate use of personnel to remove plastic, wood and other material that would otherwise clog or foul the screens. In addition to the physical hazards associated with such activities (i.e., slip, trip and fall, crushing or laceration from contact with moving machinery, etc.) such workers would also be exposed to elevated levels of gamma radiation for which practical, effective protection could not be readily and/or effectively implemented.

Regardless of which two options for removal and offsite disposal of radiologically impacted soil might be considered, extensive amounts of earth and waste moving activity would be required with the attendant potential for accidents between equipment and/or between equipment and workers. Transport of wastes by such a large number of truck and railcar trips poses real and potentially severe potential for additional accidents or possibly deaths. Moving any material across the country increases the amount of traffic on public roads and railways.

It is estimated that approximately 130,000 cubic yards of material would have to be removed from the site if off-site disposal is implemented. Assuming 20 cubic yards per truckload, moving this volume of material would require approximately 6,500 trips by heavy trucks on public roads. If the distance to the railhead were 20 miles, then the total round trip distance by the hauling fleet on public roads would be about 260,000 miles. Data collected between 1988 and 1997 by the National Highway Traffic Safety Administration demonstrates that, on average, for every 1,168,310 miles a heavy truck travels on public roads, there is a chance of an accident involving injury or death (NHTSA, 1998). This implies that the risk of an injury or fatality from hauling materials to a railhead from the site is about 2×10^{-1}.

Using the same volume assumptions discussed above, it would require about 1,300 gondola railcar loads of material, or approximately 13 100-car trainloads. If the round trip rail distance to a disposal facility is about 3,200 miles, the total rail distance for off-site disposal is about 42,000 miles. Data collected by the Federal Railroad Administration shows that between 1994 and 1998, for every 42,720 miles traveled by rail, an accident involving an injury or death occurred (USDOT), 1999). This implies that the risk of injury or death for the rail transport portion of the alternative is approximately 1.0.

The combined transportation risk for this alternative is on the order of 1.0, indicating that there is a real risk of injuring or killing someone every time off-site disposal is selected as an option. This combined transportation risk is in contrast with the current no-action risk from the Baseline Risk Assessment (Auxier, 2000) of 4×10^{-5} to the groundskeeper. Future risks to a hypothetical storage yard worker, assuming no engineered controls were placed on the site were calculated to be 4×10^{-4}. Thus, the combined transportation risk of disposing the material offsite is between 2,500 and 25,000 times greater than the calculated risk associated with leaving the material in place under a no-action scenario. Implementation of a capping alternative would reduce the onsite risk and therefore

further increase the difference in risks associated with offsite disposal compared to an onsite remedy.

Furthermore, due to the nature of the loading and transfer activities, it is expected that the truck and train transport would occur using covered loads; however, in the event of an accident, a real possibility exists that soil and refuse material could be exposed or possibly spilled on the roadways or rail lines.

The West Lake Landfill, as with all municipal landfills, also contains methane gas. Consequently, excavation of refuse at the landfill poses a potential risk for explosion hazard and creation of a landfill fire. In addition to potential physical and radiological hazards posed by excavation, regardless of the approach selected, removal of the impacted soil would require excavation of large volumes of the landfill and handling of large volumes of partially decomposed refuse with the attendant odor emissions. Although there are techniques that can be considered to reduce odor emissions, it unrealistic to assume that all of the odors that would emanate from decades-old refuse could be controlled. Consequently, it is highly likely that odor emissions would affect nearby properties and be a source of nuisance, discomfort and possibly even illness to adjacent receptors.

CONCLUSION

The overriding question posed by EPA guidance regarding potential hot spot removal is whether the combination of the waste's physical and chemical characteristics and volume is such that the integrity of the new containment system will be threatened if the waste is left in place. Neither the physical nor chemical characteristics of the radiologically impacted materials will affect the integrity of the landfill cover. Consequently, the answer to the overriding question in determining whether hot spot removal is appropriate is that the integrity of the containment remedy presumed by EPA for CERCLA municipal landfill sites would not be threatened if the radiologically impacted soil is left in place, and hot spot removal is not appropriate.

Further characterization, evaluation, and excavation/offsite disposal of potential "hot spots" within Areas 1 and 2 is not warranted. The radiologically impacted materials in Areas 1 and 2 are dispersed throughout the soil material contained within the overall matrix of municipal refuse, construction and demolition debris and unimpacted soil, cannot be classified as a "hot spot" as defined in EPA guidance, and are not known to be a principal threat waste as defined by EPA. The chemical and physical characteristics of the impacted material will not adversely affect the cap called for by the presumptive remedy. Furthermore, based on the evaluation of the four factors identified by EPA, implementation of "hot spot" removal as part of the remedial actions that may be undertaken for OU-1 at the West Lake Landfill is not considered practical. In addition, as discussed above, excavation and subsequent screening of the refuse containing the

soils with the elevated levels of radionuclides could potentially:

1. Expose remediation workers to physical hazards, gamma exposure and other unacceptable risks which, in the case of gamma exposure, could not easily or possibly effectively be mitigated with standard protective equipment;

2. Expose remediation workers, other onsite employees, offsite workers, and possible other nearby receptors to nuisance or noxious odor emissions; and

3. Expose remediation workers, onsite employees and the public to increased risks associated with potential accidents and possible spills associated with transportation by truck and rail of the excavated material to a distant offsite facility.

Consequently, excavation and offsite disposal of "hot spot" material is not considered practical, effective, beneficial or safe for Operable Unit 1 at the West Lake Landfill. Furthermore, excavation and offsite disposal of the radiologically impacted soil is inconsistent with EPA's established approach for CERCLA Municipal Landfill Sites, published EPA guidance and the National Contingency Plan.

REFERENCES

Auxier and Associates, 2000, Appendix A Baseline Risk Assessment, West Lake Landfill Operable Unit 1, April 24.

Engineering Management Support. Inc., 2000, Draft Feasibility Study, West Lake Landfill Operable Unit 1, February 18.

Engineering Management Support. Inc., 2000, Remedial Investigation Report, West Lake Landfill Operable Unit 1, April 10.

Missouri Code of State Regulations, 1998, Rules of Department of Natural Resources, Division 80-Solid Waste Management, Chapter 3-Sanitary Landfill, 10 CSR 80-3.010 Design and Operation, July 31.

USEPA, 1990, National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR 300, *Federal Register 55:8666,* March 8.

USEPA, 1991, A Guide to Principal Threat and Low Level Threat Wastes, Office of Emergency and Remedial Response, Superfund Publication 9380.3-06FS, November.

USEPA, 1993, Presumptive Remedy for CERCLA Municipal Landfill Sites, EPA 540-F-93-035, OERR Directive No. 9355.0-49FS, September.

National Highway Traffic Safety Administration, 1998, "Traffic Safety Facts 1997: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System", DOT HS 808 806, p. 30, Table 11, November.

U.S. Department of Transportation, 1999, Federal Railroad Administration, Railroad Safety Statistics Annual Report 1998, Chapter 1, pp. 7-8, July.

ATTACHMENTS

Attachment A: Presumptive Remedy for CERCLA Municipal Landfill Sites, EPA 540-F-93-035, OERR Directive No. 9355.0-49FS, September 1993.

Attachment B: A Guide to Principal Threat and Low Level Threat Wastes, Office of Emergency and Remedial Response, Superfund Publication 9380.3-06FS, November, 1991.

Attachment A:
Presumptive Remedy for CERCLA Municipal Landfill Sites

United States Environmental Protection Agency

Office of Solid Waste and Emergency Response

Directive No. 9355.0-49FS
EPA 540-F-93-035
PB 93-963339
September 1993

Presumptive Remedy for CERCLA Municipal Landfill Sites

Office of Emergency and Remedial Response
Hazardous Site Control Division 5203G

Quick Reference Fact Sheet

Since Superfund's inception in 1980, the remedial and removal programs have found that certain categories of sites have similar characteristics, such as types of contaminants present, types of disposal practices, or how environmental media are affected. Based on information acquired from evaluating and cleaning up these sites, the Superfund program is undertaking an initiative to develop presumptive remedies to accelerate future cleanups at these types of sites. The presumptive remedy approach is one tool of acceleration within the **Superfund Accelerated Cleanup Model (SACM).**

Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation. The objective of the presumptive remedies initiative is to use the program's past experience to streamline site investigation and speed up selection of cleanup actions. Over time presumptive remedies are expected to ensure consistency in remedy selection and reduce the cost and time required to clean up similar types of sites. Presumptive remedies are expected to be used at all appropriate sites except under unusual site-specific circumstances.

This directive establishes **containment** as the presumptive remedy for CERCLA municipal landfills. The framework for the presumptive remedy for these sites is presented in a streamlining manual entitled *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites,* February 1991 (OSWER Directive 9355. 3-11). This directive highlights and emphasizes the importance of certain streamlining principles related to the scoping (planning) stages of the remedial investigation/feasibility study (RI/FS) that were identified in the manual. The directive also provides clarification of and additional guidance in the following areas: (1) the level of detail appropriate for risk assessment of source areas at municipal landfills and (2) the characterization of hot spots.

BACKGROUND

Superfund has conducted pilot projects at four municipal landfill sites[1] on the National Priorities List (NPL) to evaluate the effectiveness of the manual *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites* (hereafter referred to as "the manual") as a streamlining tool and as the framework for the municipal landfill presumptive remedy. Consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (or NCP), EPA's expectation was that containment technologies generally would be appropriate for municipal landfill waste because the volume and heterogeneity of the waste generally make treatment impracticable. The results of the pilots support this expectation and demonstrate that the manual is an effective tool for streamlining the RI/FS process for municipal landfills.

Since the manual's development, the expectation to contain wastes at municipal landfills has evolved into a presumptive remedy for these sites.[2] Implementation of the streamlining principles outlined in the manual at the four pilot sites helped to highlight issues requiring further clarification, such as the degree to which risk assessments can be streamlined for source areas and the characterization and remediation of hot spots. The pilots also demonstrated the value of focusing streamlining efforts at the scoping stage, recognizing that the biggest savings in time and money can be realized if streamlining is incorporated at the beginning of the RI/FS process. Accordingly, this directive addresses those issues identified during the pilots and highlights streamlining opportunities to be considered during the scoping component of the RI/FS.

[1] Municipal landfill sites typically contain a combination of principally municipal and to a lesser extent hazardous wastes.

[2] See EPA Publication 9203.1-021, SACM Bulletins, *Presumptive Remedies for Municipal Landfill Sites,* April 1992, Vol. 1, No. 1, and February 1993, Vol. 2, No. 1, and SACM Bulletin *Presumptive Remedies,* August 1992, Vol. 1, No. 3.

Finally, while the primary focus of the municipal landfill manual is on streamlining the RI/FS, Superfund's goal under SACM is to accelerate the entire cleanup process. Other guidance issued under the municipal landfill presumptive remedy initiative identifies design data that may be collected during the RI/FS to streamline the overall response process for these sites (see Publication No. 9355.3-18FS, *Presumptive Remedies:* CERCLA *Landfill Caps Data Collection Guide*, to be published in October 1993).

CONTAINMENT AS A PRESUMPTIVE REMEDY

Section 300.430(a)(iii)(B) of the NCP contains the expectation that engineering controls, such as containment, will be used for waste that poses a relatively low long-term threat where treatment is impracticable. The preamble to the NCP identifies municipal landfills as a type of site where treatment of the waste may be impracticable because of the size and heterogeneity of the contents (55 FR 8704). Waste in CERCLA landfills usually is present in large volumes and is a heterogeneous mixture of municipal waste frequently co-disposed with industrial and/or hazardous waste. Because treatment usually is impracticable, EPA generally considers containment to be the appropriate response action, or the "presumptive remedy," for the source areas of municipal landfill sites.

The presumptive remedy for CERCLA municipal landfill sites relates primarily to containment of the landfill mass and collection and/or treatment of landfill gas. In addition, measures to control landfill leachate, affected ground water at the perimeter of the landfill, and/or upgradient ground-water that is causing saturation of the landfill mass may be implemented as part of the presumptive remedy.

The presumptive remedy does not address exposure pathways outside the source area (landfill), nor does it include the long-term ground-water response action. Additional RI/FS activities, including a risk assessment, will need to be performed, as appropriate, to address those exposure pathways outside the source area. It is expected that RI/FS activities addressing exposure pathways outside the source generally will be conducted concurrently with the streamlined RI/FS for the landfill source presumptive remedy. A response action for exposure pathways outside the source (if any) may be selected together with the presumptive remedy (thereby developing a comprehensive site response) or as an operable unit separate from the presumptive remedy.

Highlight 1 identifies the components of the presumptive remedy. Response actions selected for individual sites will include only those components that are necessary, based on site-specific conditions.

Highlight 1: Components of the Presumptive Remedy: Source Containment

- Landfill cap;
- Source area ground-water control to contain plume;
- Leachate collection and treatment;
- Landfill gas collection and treatment; and/or
- Institutional controls to supplement engineering controls.

The EPA (or State) site manager will make the initial decision of whether a particular municipal landfill site is suitable for the presumptive remedy or whether a more comprehensive RI/FS is required. Generally, this determination will depend on whether the site is suitable for a streamlined risk evaluation, as described on page 4. The community, state, and potentially responsible parties (PRPs) should be notified that a presumptive remedy is being considered for the site before work on the RI/FS work plan is initiated. The notification may take the form of a fact sheet, a notice in a local newspaper, and/or a public meeting.

Use of the presumptive remedy eliminates the need for the initial identification and screening of alternatives during the feasibility study (FS). Section 300.430(e)(1) of the NCP states that, "... the lead agency shall include art alternatives screening step, when needed, (emphasis added) to select a reasonable number of alternatives for detailed analysis."

EPA conducted an analysis of potentially available technologies for municipal landfills and found that certain technologies are routinely and appropriately screened out on the basis of effectiveness, feasibility, or cost (NCP Section 300.430(e)(7)). (See Appendix A to this directive and "Feasibility Study Analysis for CERCLA Municipal Landfills," September 1993 available at EPA Headquarters and Regional Offices.) Based on this analysis, the universe of alternatives that will be analyzed in detail may be limited to the components of the containment remedy identified in Highlight 1, unless site-specific conditions dictate otherwise or alternatives are considered that were not addressed in the FS analysis. The FS analysis document, together with this directive, must be included in the administrative record for each municipal landfill presumptive remedy site to support elimination of the initial identification and screening of site-specific alternatives. Further detailed and comprehensive

supporting materials (e.g., FS reports included in analysis, technical reports) can be provided by Headquarters, as needed.

While the universe of alternatives to address the landfill source will be limited to those component identified in Highlight 1, potential alternatives that may exist for each component or combinations of components may be evaluated in the detailed analysis. For example, one component of the presumptive remedy is source area ground-water control. If appropriate, this component may be accomplished in a number of ways, including pump and treat, slurry walls, etc. These potential alternatives may then be combined with other components of the presumptive remedy to develop a range of containment alternatives suitable for site-specific conditions. Response alternatives must then be evaluated in detail against the nine criteria identified in Section 300.430(e)(g) of the NCP. The detailed analysis will identify site-specific ARARs and develop costs on the basis of the particular size and volume of the landfill.

EARLY ACTION AT MUNICIPAL LANDFILLS

EPA has identfies the presumpitve remedy site categories as good candidates for early action under SACM. At municipal landfills, the upfront knowledge that the source area will be contained may facilitate such early actions as installation of a landfill cap or a ground-water containment system. Depending on the circumstances, early actions may be accomplished using either removal authority (e.g., non-time-critical removal actions) or remedial authority. In some cases, it may be appropriate for an Enginering Evaluation/Cost Analysis to replace part or all of the RI/FS if the source control component will be a non-time-critical removal action. Some factors may affect whether a specific response action would be better accomplished as a removal or remedial action including the size of the action, the associated state cost share, and/or the scope of O&M. A discussion of these factors is contained in *Early Action and Long-term Action Under SACM- Interim Guidance* Publication No. 92031-05I, December 1992.

SCOPING A STREAMLINED RI/FS UNDER THE PRESUMPTIVE REMEDY FRAMEWORK

The goal of an RI/FS is to provide the information necessary to: (1) adequately characterize the site; (2) define site dynamis; (3) define risks; and (4) develop the response action. As discussed in the following sections, the process for achieving each of these goals can be streamlined for CERCLA municipal landfill sites because of the upfront presumpton that landfill contents will be contained. The strategy for streamlining each of these areas should be developed early (i.e., during the scoping phase of the RI/FS).

1. Characterizing the Site

The use of existing data is especially important in conducting a streamlined RI/FS for municipal landfills. Characterization of a landfill's contents is not necessary or appropriate for selecting a response action for these sites except in limited cases; rather, existing data are used to determine whether the containment presumption is appropriate. Subsequent sampling efforts should focus on characterizing areas where contaminant migration is suspected, such as leachate discharge areas or areas where surface water runoff has caused erosion. It is important to note that the decision to characterize hot spots should also be based on existing information, such as reliable anecdotal information, documentation, and/or physical evidence (see page 6).

In those limited cases where no information is available for a site, it may not be advisable to initiate use of the presumptive remedy until some data are collected. For example, if there is extensive migration of contaminants from a site located in an area with several sources, it will be necesary to have some information about the landfill source in order to make an association between on-site and off-site contamination.

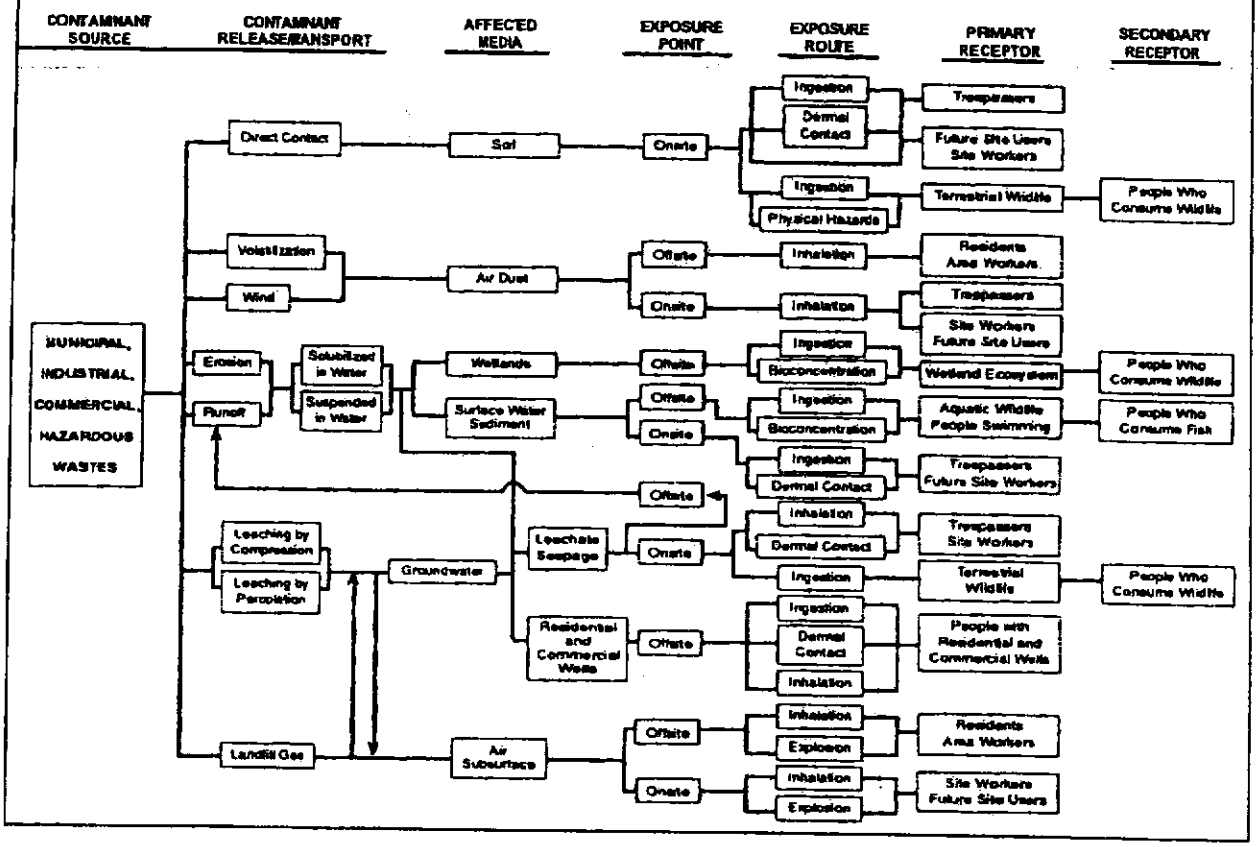
Sources of information of particular interest during scoping include records of previous ownership, state files, closure plans, etc., which may help to determine types and sources of hazardous materials present. In addition, a site visit is appropriate for several reasons, including the verification of existing data, the identification of existing site remedation systems, and to visually characterize wastes (e.g., leachate seeps). Specific information to be collected is provided in Sections 2.1 through 2.4 of the municipal landfill manual.

2. Defining Site Dynamics

The collected data are used to develop a conceptual site model, which is the key component of a streamlined RI/FS. The conceptual site model is an effective tool for defining the site dynamics, streamlining the risk evaluation, and developing the response action. Highlight 2 presents a generic conceptual site model for municipal landfill. The model is developed before any RI field activities are conducted, and its purpose is to aid in understanding and describing the site and to present hypotheses regarding

- The suspected sources and types of contaminants present;
- Contaminant release and transport mechanisms;

Highlight 2: Generic Conceptual Site Model



- Rate of contaminant release and transport (where possible);
- Affected media;
- Known and potential routes of migration and
- Known and potential human and environmental receptors.

After the data are evaluated and a site visit is completed, the contaminant release and transport mechanisms relevant to the site should be determined. The key element in developing the conceptual site model is to identify those aspects of the model that require more information to make a decision about response measures. Because containment of the landfill's contents is the presumed response action, the conceptal site model will be of most use in identifying areas beyond the landfill source itself that will require further study, thereby focusing site characterization away from the source area and on areas of potential contaminant migration (e.g., ground water or contaminated sediments).

3. Defining Risks

The municipal landfill manual states that a streamlined or limited baseline risk assessment will be sufficient to initiate response action on the most obvious problems at a municipal landfill (e.g, ground water, leachate/landfill contents, and landfill gas). One method for establishing risk using a streamlined approach is to compare contaminant concentration levels (if available) to standards that are potential chemical-specific applicable or relevant and appropriate requirements (ARARs) for the action. The manual states that where established standards for one or more contaminants in a given medium are clearly exceeded, remedial action generally is warranted[3]

It is important to note, however, that based on site-specific conditions, an active response is not required if ground-water contaminant concentrations exceed chemical-specific standards but the site risk is within the Agency's acceptable risk range (10^{-4} to 10^{-6}). For example, if it is determined that the release of

[3] See also OSWER Directive 9355.0-30, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, April 22, 1991, which states that if MCLs or non-zero MCLGs are exceeded, [a response] action generally is warranted.

contaminants from a particular landfill is declining, and concentrations of one or more ground-water contaminants are at or barely exceed chemical-specific standards, the Agency may decide not to implement an active response. Such a decision might be based on the understanding that the landfill is no longer acting as a source of ground-water contamination, and that the landfill does not present an unacceptable risk from any other exposure pathway.

A site generally will not be eligible for a streamlined risk evaluation if ground-water contaminant concentrations do not clearly exceed chemical-specific standards or the Agency's accepted level of risk, or other conditions do not exist that provide a clear justification for action (e.g., direct contact with landfill contents resulting from unstable slopes). Under these circumstances, a quantitative risk assessment that addresses all exposure pathways will be necessary to determine whether action is needed.

Ultimately, it is necessary to demonstrate that the final remedy addresses all pathways and contaminants of concern, not just those that triggered the remedial action. As described in the following sections, the conceptual site model is an effective tool for identifying those pathways and illustrating that they have been addressed by the containment remedy.

Streamlined Risk Evaluation Of The Landfill Source

Experience from the presumptive remedy pilots supports the usefulness of a streamlined risk evaluation to initiate an early response action under certain circumstances. As a matter of policy, for the source area of municipal landfills, a quantitative risk assessment that considers all chemicals, their potential additive effects, etc., is not necessary to establish a basis for action if ground-water data are available to demonstrate that contaminants clearly exceed established standards or if other conditions exist that provide a clear justification for action.

A quantitative risk assessment also is not necessary to evaluate whether the containment remedy addresses all pathways and contaminants of concern associated with the source. Rather, all potential exposure pathways can be identified using the conceptual site model and compared to the pathways addressed by the containment presumptive remedy. Highlight 3 illustrates that the containment remedy addresses all exposure pathways associated with the source at municipal landfill sites.

Finally, a quantitative risk assessment is not required to determine clean-up levels because the type of cap will be determined by closure ARARs, and ground water that is extracted as a component of the presumptive remedy will be required to meet discharge limits, or other standards for its disposal. Calculation of clean-up levels for ground-water contamination that has migrated away from the source will not be accomplished under the presumptive remedy, since such contamination will require a conventional investigation and a risk assessment.

Highlight 3: Source Contaminant Exposure Pathways Addressed by Presumptive Remedy

1. Direct contact with soil and/or debris prevented by landfill cap;
2. Exposure to contaminated ground water within the landfill area prevented by ground-water control;
3. Exposure to contaminated leachate prevented by leachate collection and treatment; and
4. Exposure to landfill gas addressed by gas collection and treatment, as appropriate.

Streamlining the risk assessment of the source area eliminates the need for sampling and analysis to support the calculation of current or potential future risk associated with direct contact. It is important to note that because the continued effectiveness of the containment remedy depends on the integrity of the containment system, it is likely that institutional controls will be necessary to restrict future activities at a CERCLA municipal landfill after construction of the cap and associated systems. EPA has thus determined that it is not appropriate or necessary to estimate the risk associated with future residential use of the landfill source, as such use would be incompatible with the need to maintain the integrity of the containment system. (Long-term waste management areas, such as municipal landfills, may be appropriate, however, for recreational or other limited uses on a site-specific basis.) The availability and efficacy of institutional controls should be evaluated in the FS. Decision documents should include measures such as institutional controls to ensure the continued integrity of such containment systems whenever possible.

Areas of Contaminant Migration

Almost every municipal landfill site has some characteristic that may require additional study, such as leachate discharge to a wetland or significant surface water run-off caused by drainage problems. These migration pathways, as well as ground-water contamination that has migrated away from the source, generally will require characterization and a more comprehensive risk assessment to determine whether action is warranted beyond the source area and, if so, the type of action that is appropriate.

While future residential use of the landfill source area itself is not considered appropriate, the land adjacent to

landfills is frequently used for residential purposes. Therefore, based on site-specific circumstances it may be appropriate to consider future residential use for ground water and other exposure pathways when assessing risk from areas of contaminant migration.

4. Developing the Response Action

As a first step in developing containment alternatives, response action objectives should be developed on the basis of the pathways identified for action in the conceptual site model. Typically, the primary response action objectives for municipal landfill sites include:

Presumptive Remedy

- Preventing direct contact with landfill contents;
- Minimizing infiltration and resulting contaminant leaching to ground water;
- Controlling surface water runoff and erosion;
- Collecting and treating contaminated ground water and leachate to contain the contaminant plume and prevent further migration from source area; and
- Controlling and treating landfil gas.

Non-Presumptive Remedy

- Remediating ground water;
- Remediating contaminated surface water and sediments; and
- Remediating contaminated wetland areas.

As discussed in Section 3, "Defining Risks," the containment presumptive remedy accomplishes all but the last three of these objectives by addressing all pathways associated with the source. Therefore, the focus of the RI/FS can be shifted to characterizing the media addressed in the last three objectives (contaminated ground water, surface water and sediments, and wetland areas) and on collecting data to support design of the containment remedy.

Treatment of Hot Spots

The decision to characterize and/or treat hot spots is a site-specific judgement that should be based on the consideration of a standard set of factors. Highlight 4 lists questions that should be answered before making the decision to characterize and/or treat hot spots. The overriding question is whether the combination of the waste's physical and chemical characteristics and volume is such that the integrity of the new containment system will be threatened if the waste is left in place. This question should be answered on the basis of what is known about a site (e.g., from operating records or other reliable information). An answer in the affirmative to all of the questions listed in Highlight 4 would indicate that it is likely that the integrity of the containment system would be threatened, or that excavation and treatment of hot spots would be practicable, and that a significant reduction in risk at the site would occur as a result of treating hot spots. EPA expects that few CERCLA municipal landfills will fall into this category; rather, based on the Agency's experience, the majority of sites are expected to be suitable for containment only, based on the heterogeneity of the waste, the lack of reliable information concerning disposal history, and the problems associated with excavating through refuse.

The volume of industrial and/or hazardous waste co-disposed with municipal waste at CERCLA municipal landfills varies from site to site, as does the amount of information available concerning disposal history. It is impossible to fully characterize, excavate, and/or treat the source area of municipal landfills, so uncertainty about the landfill contents is expected. Uncertainty by itself does not call into question the containment approach. However, containment remedies must be designed to take into account the possibility that hot spots are present in addition to those that have been identified and characterized. The presumptive remedy must be relied upon to contain landfill contents and prevent migration of contaminants. This is accomplished by a combination of measures, such as a landfill cap combined with a leachate collection system. Monitoring will further ensure the continued effectiveness of the remedy.

The following examples illustrate site-specific decision making and show how these factors affect the decision whether to characterize and/or treat hot spots.

Examples of Site-Specific Decision Making Concerning Hot Spot Characterization/ Treatment

Site A

There is anecdotal information that approximately 200 drums of hazardous waste were disposed of at this 70-acre former municipal landfill, but their location and contents are unknown. The remedy includes a landfill cap and ground-water and landfill gas treatment.

A search for and characterization of hot spots is not supported at Site A based on the questions listed in

Highlight 4: Characterization of Hot Spots

If all of the following questions can be answered in the affirmative, it is likely that characterization and/or treatment of hot spots is warranted:

1. Does evidence exist to indicate the presence and approximate location of waste?
2. Is the hot spot known to be principal threat waste?*
3. Is the waste in a discrete, accessible part of the landfill?
4. Is the hot spot known to be large enough that its remediation will reduce the threat posed by the overall site but small enough that it is reasonable to consider removal (e.g., 100,000 cubic yards or less)?

*See *A Guide to Principal Threat and Low Level Threat Wastes*, November 1991, Superfund Publication No. 9380.3-06FS.

Highlight 4: (1) no reliable information exists to indicate the location of the waste; (2) the determination of whether the waste is principal threat waste cannot be made since the physical/chemical characteristics of the wastes are unknown; (3) since the location of the waste is unknown, the determination of whether the waste is in a discrete accessible location cannot be made; (4) in this case, the presence of 200 drums in a 70-acre landfill is not considered to significantly affect the threat posed by the overall site. Rather, the containment system will include measures to ensure its continued effectiveness (e.g., monitoring and/or leachate collection) given the uncertainty associated with the landfill contents and suspected drums.

Site B

Approximately 35,000 drums, many containing hazardous wastes, were disposed of in two drum disposal units at this privately owned 80-acre inactive landfill, which was licensed to receive general refuse. The site is divided into two operable units. The remedy for Operable Unit 1 (OU 1) is incineration of drummed wastes in the two drum disposal units. The remedy for OU2 consists of treatment of contaminated ground water and leachate and containment of treatment residuals (from OU 1) and remaining landfill contents, including passive gas collection and flaring.

Treatment of landfill contents is supported at Site B because all of the questions in Highlight 4 can be answered in the affirmative: (1) existing evidence from previous investigations and sampling conducted by the state (prior to the RI) indicated the presence and approximate location of wastes; (2) the wastes were considered principal threat wastes because they were liquids and (based on sampling) were believed to contain contaminants of concern; (3) the waste is located in discrete accessible parts of the landfill; and (4) the waste volume is large enough that its remediation will significantly reduce the threat posed by the overall site.

CLOSURE REQUIREMENTS

Subtitle D

In the absence of Federal Subtitle D closure regulations, State Subtitle D closure requirements generally have governed CERCLA response actions at municipal landfills as applicable or relevant and appropriate requirements (ARARs). New Federal Subtitle D closure and post-closure care regulations will be in effect on October 9, 1993 (56 FR 50978 and 40 CFR 258).* State closure requirements that are ARARs and that are more stringent than the Federal requirements must be attained or waived

The new Federal regulations contain requirements related to construction and maintenance of the final cover, and leachate collection, ground-water monitoring, and gas monitoring systems. The final cover regulations will be applicable requirements for landfills that received household waste after October 9,1991. EPA expects that the final cover requirements will be applicable to few, if any, CERCLA municipal landfills, since the receipt of household wastes ceased at most CERCLA landfills before October 1991. Rather, the substantive requirements of the new Subtitle D regulations generally will be considered relevant and appropriate requirements for CERCLA response actions that occur after the effective date.

Subtitle C

RCRA Subtitle C closure requirements may be applicable or relevant and appropriate in certain circumstances. RCRA Subtitle C is applicable if the landfill received waste that is a listed or characteristic waste under RCRA, and:

1. The waste was disposed of after November 19,1980 (effective date of RCRA), or

*An extension of the effective date has been proposed but not finalized at this time.

2. The new response action constitutes disposal under RCRA (i.e., disposal back into the original landfill).[3]

The decision about whether a Subtitle C closure requirement is relevant and appropriate is based on a variety of factors, including the nature of the waste and its hazardous properties, the date on which it was disposed, and the nature of the requirement itself. For more information on RCRA Subtitle C closure requirements, see *RCRA ARARs: Focus on Closure Requirements* Directive No. 9234.2-04FS, October 1989.

[3]Note that disposal of only small quantity hazardous waste and household hazardous waste does not make Subtitle C applicable.

APPENDIX A
TECHNICAL BASIS FOR PRESUMPTIVE REMEDIES

This Appendix summaizes the analysis that EPA conducted of feasibilty study (FS) and Record of Decision (ROD) data from CERCLA municipal landfill sites which led to the establishment of containment as the presumptive remedy for these sites. The objectve of the study was to identfy those technologies that are consistently included in the remedies selected, those that are consistently screened out, and to identify the basis for their elimination. Results of this analysis support the decision to eliminate the initial technology identification and screening steps on a site-specfic basis for this site type. The technical review found that certain technologies are appropriately screened out based on effecfiveness, implementability, or excessive costs.

The methodology for this analysis entailed reviewing the technology identification and screening componerts of the remedy selecton process for a representative sample of municipal landfill sites. The number of times each technology was either screened out or selected in each remedy was compiled. A detailed discussion of the methodology used is provided below.

METHODOLOGY

Identification of Sites for Feasibility Study Analysis

Of the 230 municipal landfill sites on the NPL, 149 sites have had a remedy selected for at least one operable unit. Of the 149 sites, 30 were selected for this study on a random basis, or slightly greater than 20 percent. The sites range in size from 8.5 acres to over 200 acres and are located primarily in Regions 1, 2, 3, and 5. This geographical distribution approximates the distribution of municipal landfils on the NPL.

Technology Secrning and Remedial Alternative Analysis

The FS analysis involved a review of the technology identification and screening phase, including any pre-screening steps, followed by a review of the detailed analysis and comparative analysis phases. Information derived from each review was documented on site-specific data collection forms, which are available for evaluation as part of the Administrative Record for this presumptive remedy directive. The review focused on the landfill source contamination only; ground-water technologies and alternatives were not included in the analysis.

For the screening phase, the full range of technologies considered was listed on the data collection forms, along with the key reasons given for eliminating technologies from further consideration. These reasons were categorized according to the screening criteria: cost, effectiveness, or implementability. The frequency with which specific reasons were given for eliminating a technology from further consideration was then tallied and compiled into a screening phase summary table.

For the detailed analysis and comparative analysis, information on the relative performance of each technology/alternative with respect to the seven NCP criteria was documented on the site-specific data collecton forms. The advantages and disadvantages associated with each clean-up option were highlighted. In some cases, a technology was combined with one or more technologies into one or more alternatives. The disadvantages of a technology/alternative were then compiled into a detailed analysis/comparative analysis summary table, under the assumption that these disadvantages contributed to non-selection. All summary tables are available for review as part of the Administrative Record.

APPENDIX A
TECHNICAL BASIS FOR PRESUMPTIVE REMEDIES (continued)

RESULTS

The information from the technology screening and remedial alternative analysesis provided in Table 1. It demonstrates that containment (the presumptive remedy), was chosen as a component of the selected remedy at all thirty of the sites analyzed. No other technologies or treatments were consistently selected as a remedy or retained for consideration in a remedial alternative. However, at eight of the thirty sites, there were circumstances where technologies were included in the selected remedy to address a site-specific concern, such as principal threat wastes. These technologies are included in the column entitled "Tech. Not Primary Component of Alternative"[1] in Table 1 and include incineration at two sites, waste removal and off-site disposal at two sites, soil vapor extraction at two sites, and bioreclamation at one site.

Leachate collection and gas collection systems were also tracked as part of the detailed analysis and comparison of remedial alternatives. These types of systems generally were not considered as remediation technologies during the screening phases. At fifteen sites, leachate collection was selected as part of the overall containment remedy. At seventeen sites, gas collection systems were selected as part of the overall containment remedy.

This analysis supports the decision to eliminate the initial technology identification and screening step for municipal landfill sites. On a site-specific basis, consideration of remediation technologies may be retained as needed.

[1] This column title is used for record-keeping purposes only and is not meant to imply that these treatment technologies are not considered important components of the selected remedies.

TABLE 1• SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out 3: Cost	Effectiveness	Implement	# RODs Tech. Selected	# RODs Tech. Not Selected	#RODs WHERE CRITERION CONTRIBUTED TO NON-SELECTION: Protect	ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns [4]	Community Concerns [4]
Multi-layer Cap	28	25	3	0	2	2	0	18	7	1	0	0	1	3	5	3	---	---
Clay Cap	16	8	8	0	1	8	0	4	4	2	2	1	2	1	0	1	---	---
Asphalt Cap	17	0	17	0	2	14	5	0	0	0	0	0	0	0	0	0	---	---
Concrete Cap	17	0	17	0	3	14	5	0	0	0	0	0	0	0	0	0	---	---
Soil Cover	16	7	5	4	0	5	1	5	2	1	0	0	0	0	0	0	---	---
Synthetic Cap	13	3	10	0	0	10	1	2	1	1	1	1	1	1	1	1	---	---
Chemical Seal	5	0	5	0	0	4	0	0	0	0	0	0	0	0	0	0	---	---
Slurry Wall	22	5	14	3	2	8	6	2	3	3	2	2	1	2	0	2	---	---
Grout Curtain	18	0	18	0	3	15	9	0	0	0	0	0	0	0	0	0	---	---
Sheet Piling	17	1	16	0	0	13	5	0	1	0	0	0	0	0	0	0	---	---
Grout Injection	8	0	8	0	0	8	2	0	0	0	0	0	0	0	0	0	---	---
Block Displacement	5	0	5	0	0	3	3	0	0	0	0	0	0	0	0	0	---	---
Bottom Sealing	5	0	5	0	0	3	4	0	0	0	0	0	0	0	0	0	---	---

TABLE 1- SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out 3: Cost	Effectiveness	Implement	# RODs Tech. Selected	# RODs Tech. Not Selected: Protect	#RODs WHERE CRITERION CONTRIBUTED TO NON-SELECTION: ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns [4]	Community Concerns [4]
Vibrating Beam	5	0	5	0	0	3	3	0	0	0	0	0	0	0	0	0	---	---
Liners	2	0	2	0	0	1	2	0	0	0	0	0	0	0	0	0	---	---
Offsite Nonhazardous Landfill	3	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	---	---
Offsite RCRA Landfill	17	0	13	4	8	3	12	0	0	0	0	0	0	0	0	0	---	---
Offsite Landfill (unspecified)	9	1	8	0	5	3	5	1	0	0	0	0	0	0	0	0	---	---
Onsite Nonhazardous Landfill	2	0	2	0	1	1	1	0	0	0	0	0	0	0	0	0	---	---
Onsite RCRA Landfill	14	1	11	2	3	2	10	0	1	0	0	0	0	0	0	1	---	---
Onsite Landfill (unspecified)	7	0	6	1	3	3	6	0	0	0	0	0	0	0	0	0	---	---
Bioremediation (unspecified)	13	0	13	0	0	13	1	0	0	0	0	0	0	0	0	0	---	---
Bioremediation Ex-situ	10	0	10	0	0	7	7	0	0	0	0	0	0	0	0	0	---	---
Bioremediation In-situ	15	1	14	0	1	13	7	1	0	0	0	0	0	0	0	0	---	---
Dechlorinization/ APEG	6	0	5	1	1	4	2	0	0	0	0	0	0	0	0	0	---	---
Oxidation/ Reduction	12	0	12	0	1	8	5	0	0	0	0	0	0	0	0	0	---	---

TABLE 1• SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out 3: Cost	Effectiveness	Implement	# RODs Tech. Selected	# RODs Tech. Not Selected	Protect	#RODs WHERE CRITERION CONTRIBUTED TO NON-SELECTION: ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns [4]	Community Concerns [4]
Neutralization	4	0	3	1	0	2	1	0	0	0	0	0	0	0	0	0	---	---
Thermal Destruction (unspecified)	6	0	6	0	0	3	4	0	0	0	0	0	0	0	0	0	---	---
Offsite Incineration (unspecified)	19	2	14	3	9	5	10	1	1	0	0	0	0	1	1	0	---	---
Onsite Incineration (unspecified)	12	0	8	3	5	5	6	0	1	0	0	0	0	1	1	1	---	---
Fluidized Bed	9	0	9	0	5	6	4	0	0	0	0	0	0	0	0	0	---	---
Infrared	8	0	7	1	6	3	3	0	0	0	0	0	0	0	0	0	---	---
Pyrolysis	5	2	3	1	2	2	1	0	1	0	1	0	0	1	1	1	---	---
Multiple Hearth	4	0	4	0	2	2	1	0	0	0	0	0	0	0	0	0	---	---
Rotary Kiln	10	0	9	1	6	5	4	0	0	0	0	0	0	0	0	0	---	---
Vitrification	21	0	21	0	8	15	11	0	0	0	0	0	0	0	0	0	---	---
Low Temperature Thermal Desorp/ Stripping	13	1	11	1	2	9	3	0	1	0	0	0	0	0	1	0	---	---
In-situ Steam Stripping	5	0	5	0	1	4	2	0	0	0	0	0	0	0	0	0	---	---
Soil Flushing	16	2	14	0	2	9	10	0	0	0	0	0	0	0	0	0	---	---

TABLE 1• SUMMARY OF SCREENING AND DETAILED ANALYSIS FOR LANDFILLS[1]

TECHNOLOGY[2]	# FSs Where Technology Considered	# FSs Tech. Passed Screening	# FSs Tech. Screened Out	Tech. Not Primary Component of Alternative	# FSs Where Criterion Contributed To Screening Out 3: Cost	Effectiveness	Implement.	# RODs Tech. Selected	# RODs Tech. Not Selected	Protect.	#RODs WHERE CRITERION CONTRIBUTED TO NON-SELECTION: ARARs	TMV Through Treatment	Long-term Effect.	Short-term Effect.	Cost	Implem.	State Concerns[4]	Community Concerns[4]
Soil Washing	12	2	9	1	1	8	6	0	0	0	0	0	0	0	0	0	---	---
Soil Vapor Extraction (SVE)	14	1	11	2	2	9	5	1	0	0	0	0	0	0	0	0	---	---
Fixation	7	1	5	1	0	4	2	2	0	0	0	0	0	0	0	0	---	---
Stabilization/ Solidification	20	0	19	2	1	13	6	0	0	0	0	0	0	0	0	0	---	---
Aeration	7	0	7	0	0	5	3	0	0	0	0	0	0	0	0	0	---	---

[1] The study was conducted on 30 RODs and their corresponding FSs.

[2] This does not include the no-action or institutional control only alternatives. No RODs selected either of these as remedies.

[3] FSs and RODs may contain more than one criterion for screening or non-selection of technology. Also, some FSs did not fully explain the criteria for screening out a technology. Thus, the totals for screening and non-selection criteria are not equal to the number of FSs and RODs considered.

[4] Information on State and community concerns was not included in this analysis because FSs do not contain this information and RODs generally only reference supporting documentation (i.e., State concurrence letter and responsiveness summary).

Attachment B:
A Guide to Principal Threat and Low Level Threat Wastes

United States Environmental Protection Agency | Office of Solid Waste and Emergency Response | Superfund Publication: 9380.3-06FS November 1991

EPA

A Guide to Principal Threat and Low Level Threat Wastes

Office of Emergency and Remedial Response
Hazardous Site Control Division OS-220W

Quick Reference Fact Sheet

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) promulgated on March 8, 1990 states that EPA expects to use "treatment to address the principal threats posed by a site, wherever practicable" and "engineering controls, such as containment, for waste that poses a relatively low long-term threat." (40 CFR Section 300.430(a)(1)(iii).) These expectations, derived from the mandates of CERCLA §121 and based on previous Superfund experience, were developed as guidelines to communicate the types of remedies that the EPA generally anticipates to find appropriate for specific types of wastes. Although remedy selection decisions are ultimately site-specific determinations based on an analysis of remedial alternatives using the nine evaluation criteria, these expectations help to streamline and focus the remedial investigation/feasibility study (RI/FS) on appropriate waste management options. This guide explains considerations that should be taken into account in categorizing waste for which treatment or containment generally will be suitable and provides definitions, examples, and ROD documentation requirements related to waste that constitute a principal or low level threat. EPA makes this categorization of waste as principal or low level threat waste after deciding whether to take remedial action at a site. The "Interim Final Guidance on Preparing Superfund Decision Documents." (EPA/624/1-87/90, October 1990) and "A Guide to Developing Superfund Records of Decision" (Publication 9335.3-02FS-1, May 1990) provide additional information on ROD documentation.

NCP Expectations

EPA established general expectations in the NCP (40 CFR 300.430(a)(1)(iii)) to inform the public of the types of remedies that EPA has found to be appropriate for certain types of waste in the past and anticipates selecting in the future. These expectations (see Highlight 1) provide a means of sharing collected experience to guide the development of cleanup options. They reflect EPA's belief that certain source materials are addressed best through treatment because of technical limitations to the long-term reliability of containment technologies, or the serious consequences of exposure should a release occur. Conversely, these expectations also reflect the fact that other source materials can be safely contained and that treatment for all waste will not be appropriate or necessary to ensure protection of human health and the environment, nor cost effective.

Identifying Principal and Low Level Threat Wastes

The concept of principal threat waste and low level threat waste as developed by EPA in the NCP is to be applied on a site-specific basis when characterizing source material. "Source material" is defined as material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, to surface water, to air, or acts as a source for direct exposure.

HIGHLIGHT 1: NCP Expectations Involving Principal and Low Level Threat Wastes

EPA expects to:

1. Use treatment to address the principal threats posed by a site, wherever practicable.
2. Use engineering controls, such as containment, for wastes that pose a relatively low long-term threat or where treatment is impracticable.
3. Use a combination of methods, as appropriate, to achieve protection of human health and the environment. In appropriate site situations, treatment of principal threats posed by a site, with priority placed on treating waste that is liquid, highly toxic or highly mobile, will be combined with engineering controls (such as containment) and institutional controls, as appropriate, for treatment residuals and untreated waste.
4. Use institutional controls such as water use and deed restrictions to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances.

Contaminated ground water generally is not considered to be a source material although non-aqueous phase liquids (NAPLs) may be viewed as source materials. The NCP establishes a different expectation for remediating contaminated ground water (i.e., to return usable ground waters to their beneficial uses in a time frame that is reasonable given the particular circumstances of the site). Examples of source and non-source materials are provided in Highlight 2.

HIGHLIGHT 2: Examples of Source and Non-Source Materials

Source Materials

- Drummed wastes
- Contaminated soil and debris
- "Pools" of dense non-aqueous phase liquids (NAPLs) submerged beneath ground water or in fractured bedrock
- NAPLs floating on ground water
- Contaminated sediments and sludges

Non-Source Materials

- Ground water
- Surface water
- Residuals resulting from treatment of site materials

Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include liquids and other highly mobile materials (e.g., solvents) or materials having high concentrations of toxic compounds. No "threshold level" of toxicity/risk has been established to equate to "principal threat." However, where toxicity and mobility of source material combine to pose a potential risk of 10^{-3} or greater, generally treatment alternatives should be evaluated.

Low level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of release. They include source materials that exhibit low toxicity, low mobility in the environment, or are near health-based levels.

Determinations as to whether a source material is a principal or low level threat waste should be based on the inherent toxicity as well as a consideration of the physical state of the material (e.g., liquid), the potential mobility of the wastes in the particular environmental setting, and the lability and degradation products of the material. However, this concept of principal and low level threat waste should not necessarily be equated with the risks posed by site contaminants via various exposure pathways. Although the characterization of some material as principal or low level threats takes into account toxicity (and is thus related to degree of risk posed assuming exposure occurs), characterizing a waste as a principal threat does not mean that the waste poses the primary risk at the site. For example, buried drums leaking solvents into ground water would be considered a principal threat waste, yet the primary risk at the site (assuming little or no direct contact threat) could be ingestion of contaminated ground water, which as discussed above is not considered to be a source material, and thus would not be categorized as a principal threat.

The identification of principal and low level threats is made on a site-specific basis. In some situations site wastes will not be readily classifiable as either a principal or low level threat waste, and thus no general expectations on how best to manage these source materials of moderate toxicity and mobility will necessarily apply. [NOTE: In these situations wastes do not have to be characterized as either one or the other. The principal threat/low level threat waste concept and the NCP expectations were established to help streamline and focus the remedy selection process, not as a mandatory waste classification requirement.]

HIGHLIGHT 3: Examples of Principal and Low Level Threat Wastes

Wastes that generally will be considered to constitute principal threats include, but are not limited to:

- Liquids - waste contained in drums, lagoons or tanks, free product (NAPLs) floating on or under ground water (generally excluding ground water) containing contaminants of concern.
- Mobile source material - surface soil or subsurface soil containing high concentrations of contaminants of concern that are (or potentially are) mobile due to wind entrainment, volatilization (e.g., VOCs), surface runoff, or sub-surface transport.
- Highly-toxic source material - buried drummed non-liquid wastes, buried tanks containing non-liquid wastes, or soils containing significant concentrations of highly toxic materials.

Waste that generally will be considered to constitute low level threat wastes include, but are not limited to:

- Non-mobile contaminated source material of low to moderate toxicity - Surface soil containing contaminants of concern that generally are relatively immobile in air or ground water (i.e., non-liquid, low volatility, low leachability contaminants such as high molecular weight compounds) in the specific environmental setting.
- Low toxicity source material - soil and subsurface soil concentrations not greatly above reference dose levels or that present an excess cancer risk near the acceptable risk range.

Examples of principal and low level threat wastes are provided in Highlight 3.

Risk Management Decisions for Principal and Low Level Threat Wastes

The categorization of source material as a principal threat or low level threat waste, and the expectations regarding the use of treatment and containment technologies follows the fundamental decision as to whether any remedial action is required at a site. These determinations, and the application of the expectations, serve as general guidelines and do not dictate the selection of a particular remedial alternative. For example, EPA's experience has demonstrated that highly mobile wastes (e.g., liquids) are difficult to reliably contain and thus generally need to be treated. As such, EPA expects alternatives developed to address highly mobile material to focus on treatment options rather that containment approaches.

However, as stated in the preamble to the NCP (55 FR at 8703, March 8, 1990), there may be situations where wastes identified as constituting a principal threat may be contained rather than treated due to difficulties in treating the wastes. Specific situations that may limit the use of treatment include:

- Treatment technologies are not technically feasible or are not available within a reasonable time frame;
- The extraordinary volume of materials or complexity of the site make implementation of treatment technologies impracticable;
- Implementation of a treatment-based remedy would result in greater overall risk to human health and the environment due to risks posed to workers or the surrounding community during implementation; or,
- Severe effects across environmental media resulting from implementation would occur.

Conversely, there may be situations where treatment will be selected for both principal threat wastes and low level threat wastes. For example, once a decision has been made to treat some wastes (e.g., in an onsite incinerator) economies of scale may make it cost effective to treat all materials including low level threat wastes to alleviate or minimize the need for engineering/institutional controls.

While these expectations may guide the development of appropriate alternatives, the fact that a remedy is consistent with the expectations does not constitute sufficient grounds for the selection of that remedial alternative. The selection of an appropriate waste management strategy is determined solely through the remedy selection process outlined in the NCP (i.e., all remedy selection decisions are site-specific and must be based on a comparative analysis of the alternatives using the nine criteria in accordance with the NCP). Independent of the expectations, selected remedies must be protective, ARAR-compliant, cost-effective, and use permanent solutions or treatment to the maximum extent practicable. Once the final remedy is selected, consistency with the NCP expectations should be discussed as part of the documented rationale for the decision.

ROD Documentation

Declaration

The "Description of the Selected Remedy" section should note whether the remedy is addressing any source materials that constitute "principal" or "low level" threat wastes, or both.

The "Statutory Determinations" section should discuss how the selected remedy satisfies the statutory preference stated in CERCLA §121 to select remedial actions "in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principal element." In evaluating this statutory preference, the site manager needs to decide whether treatment selected in the ROD constitutes treatment as a major component of the remedy for that site. Remedies which involve treatment of principal threat wastes likely will satisfy the statutory preference for treatment as a principal element, although this will not necessarily be true in all cases (e.g., when principal threat wastes that are treated represent only a small fraction of the wastes managed through containment). Ground water treatment remedies also may satisfy the statutory preference, even though contaminated ground water is not considered a principal threat waste and even though principal threat source material may not be treated.

Decision Summary

The "Decision Summary" of the ROD should identify those source materials that have been identified as principal threat and/or low level threat wastes, and the basis for these designations. These designations should be provided in the "Summary of Site Characteristics" section as part of the discussion focusing on these source materials that pose or potentially pose a risk to human health and the environment. In addition, the "Description of Alternatives" and the "Selection of Remedy" sections should briefly note how principal and/or low level threat wastes that may have been identified are being managed.

The "Statutory Determinations" section of the ROD should include a discussion of how the statutory preference for treatment as a principal element is satisfied or explain why it is not satisfied, stating reasons in terms of the nine evaluation criteria.

NOTICE: The policies set out in this memorandum are intended solely as guidance. They are not intended, nor can they be relied upon, to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided in this memorandum, or to act at variance with the guidance, based on an analysis of specific site circumstances. The Agency also reserves the right to change this guidance at any time without public notice.

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